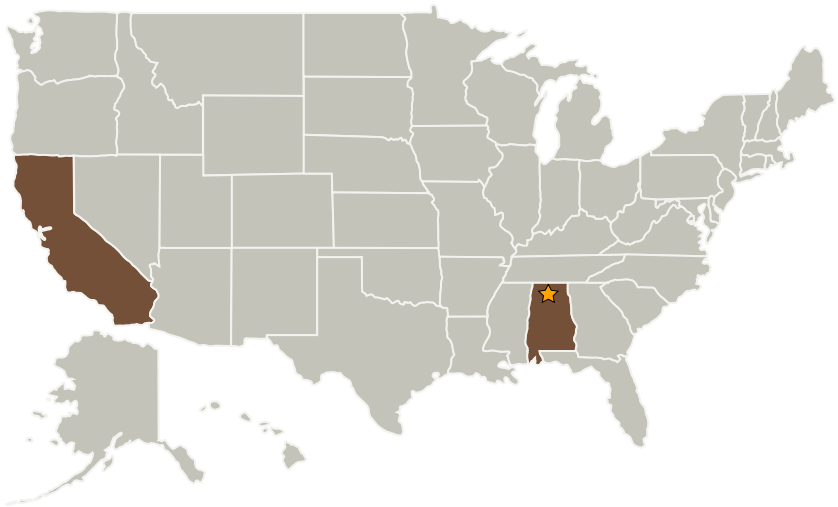
Time-stepped & discrete-event simulations of electromagnetic propulsion systems, Phase I

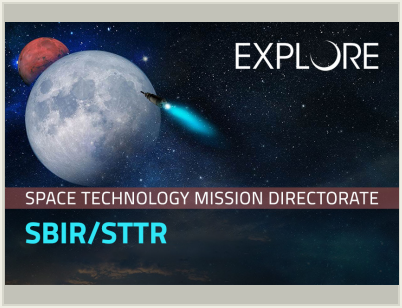
Completed Technology Project (2001 - 2002)

Project Introduction

We propose to develop a new generation of electromagnetic simulation codes with mixed resolution modeling capabilities. The need for such codes arises in many fields but our initial focus will be on modeling efforts for electromagnetic-based propellantless propulsion systems. These new codes are based on three major innovations: Multi-zone simulations with variable time-step; multi-physics simulations enabling coordination of different modeling paradigms in a single code; and the first-ever discrete-event electromagnetic simulations. No existing simulation code offers these capabilities. We will initially develop the multi-zone and multi-physics features for time-stepped simulations and apply them to the design and building of prototypes for the Mini-Magnetospheric Plasma Propulsion (M2P2). We also plan to recast a simpler version of our code into a discrete-event simulation framework. This has never been attempted but has the potential to completely change the way plasma simulations are performed, with major implications for many industries. We expect Phase II research to include further development and testing of these innovations with the aim of developing a mature product. Given their potential to alter the way future simulations will be performed, we need to thoroughly test the numerical properties of the codes before moving into full software development.

Primary U.S. Work Locations and Key Partners





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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Marshall Space Flight Center (MSFC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Marshall Space Flight Center(MSFC)	Lead Organization	NASA Center	Huntsville, Alabama
Scibernet, Inc.	Supporting Organization	Industry	San Diego, California

Primary U.S. Work Locations	
Alabama	California

Project Management

Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Project Manager:
Dennis L Gallagher

Principal Investigator:
Homa Karimabadi

Technology Areas

Primary:

- TX11 Software, Modeling, Simulation, and Information Processing
  - TX11.3 Simulation
    - TX11.3.6 Uncertainty Quantification and Nondeterministic Simulation Methods